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# Phytocoenotic originality of the N-Adriatic coastal sand dunes (Northern Italy) in the European context: The *Stipa veneta*-rich communities

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**Abstract**
The particular habitat of *Stipa veneta*, a priority species of the European Community Directive 92/43, is here described. The phytosociological analysis led to the description of a new association (*Teucrio capitati-Chrysopogonetum grylli*), endemic of the N-Adriatic fixed sand dunes. Given the high importance of the species, the conservation of its specific community should be included in a broad protection plan of this unique coastal system in the European context.

**Keywords:** *Biodiversity conservation, European directives, N-Adriatic sand dunes,* Stipa veneta, *syntaxonomy*

## Introduction

The sedimentary N-Adriatic coast is characterised by a system of Holocene dunes, made up mainly by carbonate sands, in which formation took part in some of the largest Italian rivers (Tagliamento, Piave, Brenta, Adige and Po) (Zunica 1971). The landscape is characterised by a remarkable phytocoenotic originality that is the result of a complex of many factors, both physical and biogeographical. In fact, in spite of a temperate bioclimate (Rivas-Martínez 2004), the very draining sand substratum allows the presence of a large number of xero-thermophilous species. The climatic successions, especially between the third and the first millennium BC, caused important floristic migrations: species both from the montane, Mediterranean and eastern contexts reached the N-Adriatic coast; as a result, this area, corresponding to the northernmost part of the Mediterranean basin (Figure 1), is now characterised by a unusual set of species coming from different phytogeographical regions that together contribute to the definition of communities and ecosystems found nowhere else (Lorenzoni 1983; Géhu et al. 1984; Buffa et al. 2007).

Unfortunately, owing to the heavy anthropic exploitation, at present only few coastal sites may be considered in natural or close to natural conditions.

The present work is a part of a broader project aiming to describe the fixed sand dunes system of the N-Adriatic coast, on the basis of a modern phytosociological approach.

A previous study was devoted to the phanerophytic communities (Gamper et al. 2008); here we describe the exclusive habitat of *Stipa veneta* Moraldo, a priority species of the European Community 92/43 ''Habitat'' Directive. *Stipa veneta* was described by Moraldo (1986) as an endemic species of the Venice Lagoon; nevertheless, even Beguinot (1941) supposed a taxonomic autonomy of the specimens coming from the Venetian coast from ''*Stipa pennata* L.''. This author also underlined their distinctive ecology; actually, this species is the only one of the *Stipa* genus which inhabits coastal dunes in Europe (Moraldo 1986). At present, *Stipa veneta* is known only in few fragmented localities of the Venetian and Friulian coast; the Cavallino peninsula (Venezia) represents the southernmost site, whereas the northernmost site is situated along the Tagliamento river mouth (Veneto-Friuli) (Conti et al. 2005; Scoppola

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& Spampinato 2005); the only other known locality corresponds to the ''Valle Vecchia'' (Caorle, Venezia). During the present study, the most important metapopulation, both for number of individuals and for surface occupied, was recognised at the Tagliamento river mouth. In all these localities, the species is closely-related with xerophilous hemicryptophytic communities.

## Materials and methods

The analysis was carried out on 18 unpublished phytosociological relevés. Data were collected according to the cover-abundance scale of Braun-Blanquet (1964). The surveys were elaborated on the basis of hierarchical classification (Anderberg 1973; Westhoff & Van der Maarel 1978) using the package Syn-tax 2000 (Podani 2001) (Figure 2). In the phytosociological table (Table I), the relevés sequence corresponds to that of the dendrogram. The concepts of character, differential and transgressive species are in accordance with Mucina (1993). In the phytosociological table, symbols are as follows: d = differential species; part. char. = partial characteristic species; tg = transgressive characteristic species; C = Class; O = Order. Life forms are in accordance with Pignatti (1982); chorotypes were deduced mainly from Pignatti (1982) and Aeschimann et al. (2004). The biological spectrum was weighted using cover values, while the chorological one was calculated on the basis of the frequency data. The taxonomic nomenclature corresponds to Pignatti (1982) and Aeschimann et al. (2004) with the exception of *Peucedanum cervaria* (L.) Lapeyr. var. *microphyllum* Posp. and *Vincetoxicum hirundinaria* Medicus ssp. *laxum* (Bartl.) Poldini; with regard to briophytes, we followed Cortini Pedrotti (2001); for some critical groups (*Koeleria gracilis* gr. and *Silene* sect. *Otites*) we followed Arnow (1994) and Wrigley (1986, 1993), respectively.

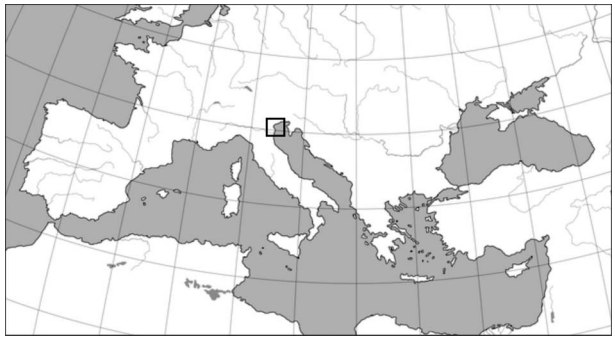

Figure 1. The study area in the Mediterranean context.

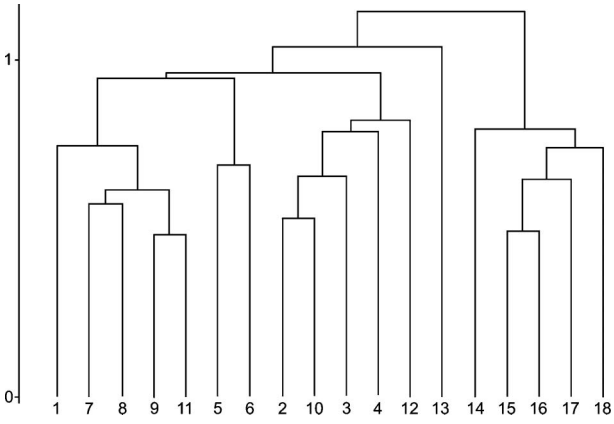


Figure 2. Dendrogram of the 18 relevés of Table I. Algorithm: complete link, chord distance; cover data.

## Results and discussion

The floristic-sociological analysis of Table I clearly points out the membership of the relevés to the *Festuco-Brometea* class and to the SE-European–Illyrian order *Scorzonero-Chrysopogonetalia*; in fact, a number of character species of this order is present with significant frequency values (*Sanguisorba minor* ssp. *muricata*, *Chrysopogon gryllus*, *Scabiosa gramuntia*, *Thymus longicaulis*, etc.); even *Silene* x *pseudotites*, a S-European entity (Wrigley 1986), may be considered as a character species of this order.

On the whole, the community shows a reduction in the number of *Saturejion subspicatae* species in comparison with other phytocoenosis described for inner regions not so far from the study area (Lasen 1989, 1995; Feoli Chiapella & Poldini 1994; Tasinazzo 2001); nevertheless, in our opinion, the presence of xerophilous species such as *Fumana procumbens*, *Allium sphaerocephalon*, *Thesium divaricatum*, *Teucrium montanum*, assures the attribution to this alliance. In fact, *Saturejion subspicatae* includes the communities of *Scorzonero-Chrysopogonetalia* that develop on soils much less mature compared with those of the *Scorzonerion villosae* (Feoli Chiapella & Poldini 1994); these ecological conditions perfectly fit the primitive and strong draining soils of the examined sand dunes.

A clear link to a suballiance level is not as straight forward. There is no evidence for the Illyrian-Dinaric *Saturejenion subspicatae*, while the high frequency of *Chamaecytisus purpureus*, here with a demontane character (Gamper et al. 2008), could allow us to set the community in *Centaureenion dicroanthae*, which substitutes *Saturejenion subspicatae* westwards; this hypothesis could also be supported by the high presence of *Carex liparocarpos*, but its syntaxonomical position in the N-Adriatic littoral context will be better discussed afterwards. However, the reference to *Centaureenion dicroanthae* must be considered as provisional since this Illyrian-prealpic suballiance includes associations mainly distributed from the

Table I. *Teucrio capitati-Chrysopogonetum grylli* ass. nova.

| | | No. of relevé | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Presence | Frequency Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Exp. | SE | SW | N | SSE | – | – | SW | S | NE | SW | – | – | – | – | – | – | – | – | | |
| | | Slope (°) | 2 | 4 | 3 | 10 | – | – | 3 | 8 | 5 | 5 | – | – | – | – | – | – | – | – | | |
| | | Surface (m2) | 6 | 6 | 8 | 10 | 12 | 12 | 8 | 10 | 9 | 12 | 10 | 8 | 8 | 10 | 8 | 10 | 9 | 10 | | |
| | | Total cover (%) | 90 | 97 | 80 | 80 | 80 | 90 | 80 | 85 | 90 | 85 | 75 | 90 | 95 | 85 | 80 | 85 | 95 | 95 | | |
| | | Cryptogamic cover (%) | 30 | 25 | 30 | 50 | 45 | 10 | 5 | 70 | 70 | 25 | 20 | 10 | 10 | 20 | 40 | 35 | 15 | 20 | | |
| | | No. of species | 20 | 26 | 28 | 21 | 24 | 26 | 26 | 26 | 29 | 27 | 27 | 26 | 18 | 27 | 30 | 35 | 20 | 32 | | |
| | | Char. and diff. species of *Teucrio capitati-Chrysopogonetum grylli* | | | | | | | | | | | | | | | | | | | | |
| H caesp | End. N-Adriatic coast | *Stipa veneta* (part. char.) | · | 2 | 2 | 2 | 3 | · | + | · | 2 | + | 1 | 4 | · | 1 | 2 | 3 | 2 | 2 | 14 | IV |
| Ch suffr | Steno-Medit. | *Teucrium polium* ssp. *capitatum* (d) | 3 | 1 | · | + | 2 | · | · | 3 | 2 | 2 | 2 | 2 | 1 | + | + | 1 | + | · | 14 | IV |
| G rhiz | SE-Europ. | *Carex liparocarpos* (d) | 1 | 1 | 1 | 1 | + | 1 | 1 | 1 | 1 | 2 | 1 | · | · | 1 | · | · | · | 1 | 13 | IV |
| G rhiz | Steno-Medit. | *Holoschoenus romanus* (d) | + | + | + | · | 1 | · | + | · | · | · | + | · | + | · | + | 1 | + | 1 | 11 | IV |
| | | Diff. species of *Teucrio capitati-Chrysopogonetum grylli schoenetosum nigricantis* | | | | | | | | | | | | | | | | | | | | |
| H caesp | Subcosmop. | *Schoenus nigricans* | · | + | · | · | · | · | · | · | · | · | · | · | + | 1 | 1 | 1 | 1 | 2 | 7 | II |
| G bulb | C-Europ. | *Gladiolus palustris* | · | · | · | · | · | · | · | · | · | · | · | + | · | · | + | + | · | + | 4 | II |
| H caesp | Europ. | *Molinia arundinacea* | · | · | · | · | · | · | · | · | · | · | · | · | · | · | · | + | 3 | 2 | 3 | I |
| | | Char. and diff. species of *Centaureenion dichroanthae* and *Saturejion subspicatae* | | | | | | | | | | | | | | | | | | | | |
| Ch suffr | Eurimedit.-Pont. | *Fumana procumbens* (d) | 2 | 1 | 2 | 1 | 1 | · | + | 1 | 1 | 2 | · | · | 1 | + | + | 1 | · | + | 14 | IV |
| Ch suffr | E-Alp.-Illyric | *Chamaecytisus purpureus* (d) | · | 2 | + | 1 | 1 | · | · | 1 | + | · | · | + | · | 2 | 1 | 1 | 2 | 1 | 12 | IV |
| G bulb | Euri-Medit. | *Allium sphaerocephalon* (d) | + | + | + | · | · | · | · | · | · | 1 | + | + | · | · | + | + | · | + | 9 | III |
| H scap | Euri-Medit. | *Thesium divaricatum* (tg O) | + | + | + | · | 2 | · | · | · | · | · | · | · | · | + | · | + | · | · | 6 | II |
| Ch suffr | Oroph. S-Europ. | *Teucrium montanum* (tg C) | · | · | · | · | · | 1 | 1 | · | · | + | + | · | + | · | · | · | · | + | 6 | II |
| H caesp | Eurasiat. temp. | *Carex humilis* (tg C) | · | · | · | · | · | + | · | · | · | · | · | · | · | · | · | · | · | · | 1 | I |
| | | Char. species of *Scorzonero-Chrysopogonetalia* | | | | | | | | | | | | | | | | | | | | |
| H scap | S-Europ.-SW Asiat. | *Sanguisorba minor* ssp. *muricata* (tg C) | 1 | + | + | 1 | 1 | + | · | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | V |
| H caesp | S-Europ.-S-Siber. | *Chrysopogon gryllus* | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | + | 1 | 1 | 4 | 3 | · | + | · | · | 15 | V |
| H scap | S-Europ. | *Scabiosa gramuntia* | + | + | 1 | + | + | + | 1 | 2 | 2 | 1 | 1 | + | · | + | + | · | · | + | 15 | V |
| Ch rept | S-Europ. | *Thymus longicaulis* (incl. *Thymus* × *carstiensis*) | · | + | + | + | 1 | 2 | 1 | 2 | 1 | + | · | + | + | · | 1 | + | · | · | 13 | IV |
| H ros | S-Europ. | *Silene x pseudotites* | · | · | + | 1 | + | · | · | 1 | + | + | 1 | + | + | · | + | + | · | · | 11 | IV |
| H scap | Euri-Medit.-S-Siber. | *Aster linosyris* | · | + | · | · | · | + | · | + | + | + | + | + | · | + | + | · | · | + | 10 | III |
| H rept | SE-Europ. | *Pseudolysimachion barrellieri* ssp. *nitens* | · | · | · | · | · | 2 | · | · | · | · | · | · | · | · | · | + | · | · | 2 | I |
| H scap | Paleotemp. | *Lotus corniculatus* var. *hirsutus* | · | · | · | · | · | + | · | · | · | · | · | · | · | + | · | · | · | · | 2 | I |
| H bienn | SE-Europ.-S-Siber. | *Campanula sibirica* | · | · | · | · | · | · | · | · | + | · | · | · | · | · | · | · | · | · | 1 | I |

(*continued*)

Table I. (*Continued*).

| | | No. of relevé | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Presence | Frequency Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Char. species of *Festuco-Brometea* | | | | | | | | | | | | | | | | | | | | |
| Ch suffr | Europ.-Caucas. | *Helianthemum nummularium* ssp. *obscurum* | 1 | · | 1 | 1 | 1 | 1 | 1 | 1 | + | 1 | 1 | + | 2 | + | 1 | 1 | 1 | 1 | 17 | V |
| H caesp | SE-Europ. | *Festuca rupicola* | 2 | + | + | 1 | + | 2 | 2 | 2 | 1 | · | · | + | · | 1 | 1 | 1 | 1 | + | 15 | V |
| H caesp | Paleotemp. | *Bromus erectus* ssp. *erectus* | 2 | 3 | 2 | 3 | 2 | + | 2 | · | 2 | 1 | · | + | · | 2 | 2 | 2 | 3 | 1 | 15 | V |
| H caesp | Europ. | *Koeleria pyramidata* | + | 1 | + | 2 | 2 | 2 | 1 | 3 | 2 | 3 | + | + | 2 | · | 1 | + | · | · | 15 | V |
| Ch suffr | Euri-Medit. | *Teucrium chamaedrys* | · | + | 1 | + | 1 | + | 2 | 2 | 2 | 1 | 1 | 2 | · | + | + | 1 | + | · | 15 | V |
| H scap | S-Europ. | *Globularia punctata* | · | · | 1 | + | 1 | 1 | 1 | 1 | 2 | 1 | · | + | · | + | 1 | 1 | · | · | 12 | IV |
| G bulb | Euri-Medit. | *Anacamptis pyramidalis* | + | + | + | · | + | · | · | + | + | · | · | + | · | · | + | + | + | · | 10 | III |
| H scap | Eurasiat. | *Galium verum* ssp. *verum* | · | · | + | · | · | · | + | + | + | · | + | · | · | + | + | · | + | 1 | 9 | III |
| H caesp | Europ. | *Brachypodium rupestre* . | · | · | · | · | · | · | 2 | · | · | · | 1 | · | · | + | + | + | + | 1 | 7 | II |
| H scap | Eurasiat. | *Scabiosa columbaria* | · | · | · | + | + | + | · | 1 | + | · | · | · | · | · | · | · | · | · | 5 | II |
| H scap | Eurasiat. | *Carex caryophyllea* | · | · | · | · | · | · | 1 | · | · | · | · | · | · | + | · | 1 | 1 | · | 4 | II |
| H scap | C-Europ. | *Euphorbia cyparissias* | + | · | · | · | · | + | 2 | · | · | · | 1 | · | · | · | · | · | · | · | 4 | II |
| G bulb | Euri-Medit.-W-Asiat. | *Orchis coriophora* ssp. *fragrans* | · | + | · | · | · | · | · | · | · | · | + | · | · | · | · | + | + | · | 4 | II |
| G rhiz | Europ. | *Carex flacca* ssp. *flacca* | · | · | · | · | · | · | · | · | · | · | · | · | · | · | + | + | · | + | 3 | I |
| H scap | Euri-Medit. | *Silene vulgaris* ssp. *angustifolia* | · | · | · | + | · | · | · | + | + | · | · | · | · | · | · | · | · | · | 3 | I |
| H scap | E-Europ.-W-Asiat. | *Polygala comosa* | · | · | · | · | · | · | · | · | · | + | · | · | + | · | · | · | · | + | 3 | I |
| G bulb | Euri-Medit. | *Orchis tridentata* | · | · | · | · | · | · | · | · | · | · | · | + | · | + | · | · | · | · | 2 | I |
| G bulb | Europeo-Caucas. | *Orchis morio* | · | · | · | · | · | · | · | · | · | · | · | · | · | · | · | + | · | + | 2 | I |
| H caesp | CS-Europ. | *Hippocrepis comosa* | · | · | · | · | · | · | · | · | · | | · | · | + | · | · | · | · | · | 1 | I |
| | | Other species | | | | | | | | | | | | | | | | | | | | |
| H scap | Submedit.-Subatl. | *Diplotaxis tenuifolia* | + | + | + | + | + | + | + | + | + | + | · | + | · | · | · | · | · | + | 12 | IV |
| G rhiz | Submedit.-Subatl. | *Anthericum ramosum* | · | 1 | + | · | · | 1 | + | · | · | · | · | 1 | · | + | + | + | · | 1 | 9 | III |
| H caesp | Paleotemp. | *Dactylis glomerata* | · | · | · | · | · | + | 1 | · | · | · | + | + | + | 1 | · | · | + | · | 7 | II |
| H ros | Cosmop. | *Plantago lanceolata* var. *sphaerostachya* | 1 | + | + | · | + | · | · | + | · | · | · | + | · | · | · | + | · | · | 7 | II |
| NP | Euri-Medit. | *Osyris alba* | · | · | · | + | + | · | · | · | + | · | + | · | · | + | · | + | · | + | 7 | II |
| G rhiz | Circumbor. | *Polygonatum odoratum* | · | · | 1 | · | · | · | · | · | 1 | · | · | + | · | · | 1 | · | + | + | 6 | II |
| P lian | Euri-Medit. | *Clematis flammula* | · | · | · | · | · | · | · | + | + | · | + | · | · | · | 1 | + | · | + | 6 | II |
| H caesp | Euri-Medit. | *Petrorhagia saxifraga* | · | · | · | · | + | + | · | + | · | + | · | + | + | · | · | · | · | · | 6 | II |
| G rhiz | Circumbor. | *Equisetum ramosissimum* | · | + | + | · | · | · | + | · | + | + | · | + | · | · | · | · | · | · | 6 | II |
| T scap | Cosmop. | *Cerastium semidecandrum* | + | + | 1 | · | · | · | · | · | · | + | · | · | · | · | · | · | · | · | 4 | II |
| G rhiz | Steno-Medit. | *Asparagus acutifolius* | · | · | · | · | · | + | · | + | + | · | · | · | · | · | · | + | · | · | 4 | II |
| | | Cryptogams cover-abundance value | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 18 | V |
| | | N. of acciental species | 1 | 1 | 2 | 1 | 0 | 3 | 3 | 2 | 1 | 4 | 5 | 0 | 2 | 2 | 3 | 2 | 1 | 5 | | |

Pleistocene high plain to the Alpine piedmont, on primitive but never quite sandy soils and therefore rather far from the phytogeographical and ecological context of the coastal sand dunes system.

With regard to the association level, the floristic composition of the community substantially differs from those of all the *Saturejion subspicatae* associations yet described. Species such as *Asperula cynanchica*, *Carex humilis*, *Bromus condensatus*, *Galium lucidum*, *Anthyllis vulneraria* ssp. *polyphylla*, *Globularia cordifolia*, *Dianthus sylvestris*, *Peucedanum oreoselinum*, *Plantago holosteum*, *Stachys recta* ssp. *labiosa*, etc. are absent or only accidentally present. In addition, the community is easily distinguishable from others belonging to the *Festuco-Brometea* class for the high frequency of exclusive entities such as the steno-Mediterranean *Teucrium polium* ssp. *capitatum* and *Holoschoenus romanus* and the endemic *Stipa veneta*.

As far as *Carex liparocarpos* is concerned, it is quoted among the differential species of *Centaureenion dichroanthae* by Feoli Chiapella and Poldini (1994) or as belonging to *Festuco-Brometea* (Aeschimann et al. 2004); it is actually absent or only accidentally present in the communities mentioned before belonging to this class, while it is very frequent in the fixed sand dunes of the N-Adriatic coast as clearly pointed out by Pignatti (1982). In this area, *Carex liparocarpos* shows its ecological optimum both in the studied association and in the much more widespread thero-chamaephytic communities belonging to *Tortulo-Scabiosetum*. For these reasons, in our opinion, this species may be considered as a good differential entity of the community.

On the basis of the above considerations, the relevés of Table I may be referred to a new association, named *Teucrio capitati-Chrysopogonetum grylli*.

*Teucrio capitati-Chrysopogonetum grylli* ass. nova

*Physiognomy and structure.* Dry grassland whose structure is mainly determined by hemicryptophytes and, subordinately, by chamaephytes; a cryptogamic layer, mostly formed by *Syntrichia ruraliformis* and *Cladonia* sp.pl., is always present, even if with variable cover values.

*Biological spectrum.* Hemicryptophytes 69.5%, chamaephytes 25.3%, geophytes: 4.7%, phanerophytes: 0.24%, therophytes: 0.2%.

*Character and differential species.* *Stipa veneta* (part. char.), *Teucrium polium* ssp. capitatum (d), *Carex liparocarpos* (d), *Holoschoenus romanus* (d).

*Synecology.* The community occurs only on paleodunes, generally far from the present coastline, where it develops on soils that, according to USDA (1998), correspond to Typic Haploxerepts.

*Syntaxonomy.* The analysis of Table I and the results of the cluster analysis (Figure 2) allow us to recognise two different aspects. Rel. 1-13 represent the typical features of the association (subass. *typicum*); it develops on flat or slightly sloping sites of the dunes and is characterised by a strong edaphic dryness; *Teucrium polium* ssp. *capitatum*, *Fumana procumbens*, *Carex liparocarpos*, *Chrysopogon gryllus* are more abundant and/or more frequent in these conditions. The remaining relevés (14–18) localised in slightly lowered areas, characterised by periods of relative higher soil moisture; these stands correspond to a distinct subassociation (*Teucrio capitati-Chrysopogonetum grylli schoenetosum nigricantis*), which is differentiated by *Schoenus nigricans*, *Molinia arundinacea* and *Gladiolus palustris*. The relevés that Piccoli and Merloni (1989) made south of the Po Delta (Ravenna) and ascribed by these authors to *Schoeno-Chrysopogonetum grylli*, without any doubt correspond to this last subassociation.

*Syndinamic.* *Teucrio capitati-Chrysopogonetum grylli* is a secondary community of the holm-oak wood edaphoxerophilous series (*Vincetoxico-Querco ilicis* sigmetum) (Gamper et al. 2008).

*Synchorology.* It is an endemic association of the N-Adriatic Holocene paleodunes; it is present, although with many gaps, from the Tagliamento river mouth to the south of the Po Delta. The subass. *typicum* reaches the Cavallino peninsula, while the subass. *schoenetosum nigricantis* may be recognised up to the southern limits of distribution of the association.

*Chorological spectrum.* Mediterranean 31.6%, Eurasiatic 17.9%, Illyrian and Eastern 17.4%, S-European 13.1%, European 8.3%, Cosmopolitan 5.4%, Endemic 3.5%, Northern 2.8%.

Natura 2000. This new endemic association further contributes to outline the biocoenotic originality of the N-Adriatic coast with respect to the other European coastal sand dune systems. In fact, as already stressed by Gamper et al. (2008), this area is characterised by a high number of endemic associations that create a landscape absolutely unique and remarkable. In the general context of nature conservation, it is very important to work out, as soon as possible, a protection plan for this *Stipa veneta*-rich community as well as for all the other communities and the entire coastal landscape.

On this subject, some reflections may be suitable. According to the Interpretation Manual of European Union Habitats (European Commission DG Environment 2007), *Teucrio–Chrysopogonetum grylli* surely must be referred to the Habitat 62A0 [Eastern sub-Mediterranean dry grasslands (*Scorzoneretalia villosae*)]. From this point of view, it is rather surprising that this habitat was not regarded as priority habitat, in the same way of 6210 [Semi-natural dry grasslands

and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchis sites)]; in fact, 6210 is *expressis verbis* defined as: ''Dry to semi-dry calcareous grasslands of the *Festuco-Brometea*''. The order *Scorzoneretalia villosae* (= *Scorzonero-Chrysopogonetalia*) is part of the class *Festuco-Brometea* and includes a number of communities rich in orchids as well as in important endemic species, such as the priority *Stipa veneta*.

For all these reasons, in our opinion the Habitat 62A0 should be defined as priority; this proposal does not have simply the meaning of a precise definition, but represents an opportunity that should be valued with attention, keeping in mind the importance that the priority status of one habitat has for its protection.

*Syntaxonomic scheme*

*Festuco-Brometea* Br.-Bl. et Tüxen in Br.-Bl. 1949
- *Scorzonero-Chrysopogonetalia* Horvatić et Horvat in Horvatić 1958
  - *Saturejion subspicatae* (Horvat 1962) Horvatić 1973
    - *Centaureenion dicroanthae* (Pignatti 1953) Poldini et Feoli Chiapella in Feoli Chiapella et Poldini 1994
      - *Teucrio capitati-Chrysopogonetum grylli* ass. nova (*holotypus*: Table I, rel. 5)
      - *Teucrio capitati-Chrysopogonetum grylli typicum* subass. nova (*holotypus*: Table I, rel. 5)
      - *Teucrio capitati-Chrysopogonetum grylli schoenetosum nigricantis* subass. nova (*holotypus*: Table I, rel. 18)
      - (Pseudonym: *Schoeno-Chrysopogonetum grylli* sensu Piccoli et Merloni 1989 non Pignatti 1953)



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## Appendix A. Nomenclature of the syntaxa not present in the syntaxonomical scheme

*Saturejenion subspicatae* (Horvat 1962) Horvatić 1973
*Schoeno nigricantis-Chrysopogonetum grylli* Pignatti et ex Feoli Chiapella Poldini 1994
*Scorzoneretalia villosae* Horvatić 1975
*Scorzonerion villosae* Horvatić 1963
*Tortulo-Scabiosetum* Pignatti 1953

## Appendix B. Sites of the relevés

Rel. 1-5, 8, 9, 12, 15-18: Bibione Faro (S. Michele al Tagliamento, Venezia) (rel. 15-17: unpublished relevés of L. Poldini); rel. 6: Bibione (S. Michele al Tagliamento, Venezia); rel. 7: Valle Grande di Bibione (S. Michele al Tagliamento, Venezia); rel. 10: Valle Vecchia (Caorle, Venezia); rel. 11: Duna Vecchia di Cavallino (Venezia); rel. 13: Ca' Ballarin (Cavallino, Venezia); rel. 14: Lignano Riviera (Udine) (unpublished relevé of L. Poldini).

## Appendix C. Accidental species to Table I

*Allium vineale*: rel. 6, 7, 8; *Ambrosia coronopifolia*: rel. 13; *Calamagrostis epigejos*: rel. 10; *Catapodium rigidum*: rel. 2; *Centaurea tommasinii*: rel. 10(1); *Centaurium erythraea*: rel. 7; *Cephalanthera longifolia*: rel. 3; *Cerastium brachypetalum*: rel. 15, 16; *Clypeola jonthlaspi*: rel. 15, 18; *Cynodon dactylon*: rel. 9, 11; *Dorycnium pentaphyllum* ssp. *herbaceum*: rel. 18; *Elytrigia atherica*: rel. 10(1), 13; *Erica carnea* L.: rel. 6, 8, 18(2); *Erigeron annuus*: rel. 3, 15; *Genista germanica*: rel. 18; *Genista tinctoria*: rel. 17; *Odontites lutea*: rel. 14; *Oenothera biennis* s.l.: rel. 7, 16; *Peucedanum cervaria* var. *microphyllum*: rel. 14; *Phleum arenarium*: rel. 4, 11; *Poa bulbosa*: rel. 1, 11(1); *Scabiosa argentea*: rel. 11; *Stachys recta* ssp. *recta*: rel. 6(1), 10, 11(1); *Tetragonolobus maritimus* : rel. 18; *Vincetoxicum hirundinaria* ssp. *laxum*: rel. 7.